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L8 and ((149/$)!.CCLS.)	88

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L8	(restraint or air adj bag) and non-azide	150	L8
L7	L5 and ((149/$)!.CCLS.)	7	L7
L6	(restraint or air adj bag) and (two near part) same fuel	18	L6
L5	(restraint or air adj bag) and (two near part)	2596	L5
L4	hydrotalcite and ((149/$)!.CCLS.)	3	L4
L3	L1 not L2	26	L3
L2	L1 and (micron or particle adj size)	17	L2
L1	low near fuel and ((149/$)!.CCLS.)	43	L1

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	DB=USPT,PGPB; PLUR=YES; OP=OR		
L10	L9 and ((149/$)!.CCLS.)	6	L10
L9	silicon adj nitride and (air adj bag or airbag or restraint)	393	L9
L8	L2 and silicon adj nitride	2	L8
L7	L4 and silicon adj nitride	0	L7
L6	L5 and silicon adj nitride	0	L6
L5	L3 and ((149/$)!.CCLS.)	41	L5
L4	L3 and (air adj bag or airbag or restraint)	55	L4
L3	L2 same l1	57	L3
L2	5at or aminotetrazole	585	L2
L1	guanidine adj nitrate	360	L1

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L5: Entry 37 of 41 File: USPT May 21, 1996

DOCUMENT-IDENTIFIER: US 5518054 A
TITLE: Processing aids for gas generants

Brief Summary Text (10):
The gas generant formulations may be formulated with any known fuel. Most airbags today use an azide, particularly sodium azide as fuel. However, there is a desire to get away from the use of azide fuels and a number of other fuels have been proposed, including tetrazoles, such as 5-aminotetrazole, tetrazole, bitetrazole, metal salts of tetrazoles; 1,2,4-triazole-5-one, 3-nitro 1,2,4-triazole-5-one and metal salts of triazoles; dicyanamide; dicyandiamide; nitrates, such as guanidine nitrate, aminoguanidine nitrate, diaminoguanidine nitrate, semicarbazide nitrate, triaminoguanidine nitrate, ethylenediamine dinitrate and hexamethylene tetramine dinitrate. The fuel will typically comprise between about 15 and about 70 wt % of the gas generant composition. The oxidizer will typically comprise between about 20 and about 80 wt % of the gas generant composition.

Detailed Description Text (10):
A gas generant formulation of 71.08 wt % CuO, 12.00 wt % guanidine nitrate, 16.92 wt % 5-aminotetrazole (5AT) was prepared. Based on the weight of the generant formulation, release agent was added per table 4 below. The formulation was pressed in a Carver press at 40,000 psi and release forces were measured.

Current US Original Classification (1):
149/35

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L3 and ((149/$)!.CCLS.)	41

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Set Name side by side	Query	Hit Count	Set Name result set
	DB=USPT,PGPB; PLUR=YES; OP=OR		
L5	L3 and ((149/$)!.CCLS.)	41	L5
L4	L3 and (air adj bag or airbag or restraint)	55	L4
L3	L2 same l1	57	L3
L2	5at or aminotetrazole	585	L2
L1	guanidine adj nitrate	360	L1

END OF SEARCH HISTORY

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L5: Entry 34 of 41 File: USPT May 26, 1998

DOCUMENT-IDENTIFIER: US 5756929 A
TITLE: Nonazide gas generating compositions

Detailed Description Text (17):
A mixture of 5-aminotetrazole (5AT), guanidine nitrate, and strontium nitrate was prepared having the following composition in percent by weight: 25.00% 5AT, 25.00% guanidine nitrate, and 50.00% strontium nitrate. These powders were ground separately and dry blended. When ignited at atmospheric pressure with a fuse and a small ignition charge of Dupont 4227 smokeless powder, the composition burned thoroughly leaving a hard, porous klinker like residue which is easily filterable. The pH of an 800 ml aqueous rinse was 11.

Detailed Description Text (29):
A mixture of 5AT, guanidine nitrate, and strontium nitrate was prepared having the following composition in percent by weight: 23.26% 5AT, 16.08% guanidine nitrate, and 60.66% strontium nitrate. These powders were ground separately and dry blended. When ignited at atmospheric pressure with a fuse and a small ignition charge of Dupont 4227 smokeless powder, the mixture burned smoothly and completely and left a hard porous klinker like residue which is readily filterable.

Detailed Description Text (35):
A mixture of 5AT, guanidine nitrate, and strontium nitrate was prepared having the following composition in percent by weight: 20.60% 5AT, 24.12% guanidine nitrate, and 55.28% strontium nitrate. These powders were ground separately and dry blended. When ignited at atmospheric pressure with a fuse and a small ignition charge of Dupont 4227 smokeless powder, the mixture burned smoothly and completely and left a hard porous klinker like residue which is readily filterable. The pH of an 800 ml aqueous rinse was 11.

Detailed Description Text (41):
A mixture of 5AT, guanidine nitrate, and strontium nitrate was prepared having the following composition in percent by weight: 26.79% 5AT, 12.49% guanidine nitrate, and 60.72% strontium nitrate. The powders were ground separately and dry blended. When ignited at atmospheric pressure with a propane torch, the composition burned completely forming a hard residue which was somewhat porous and readily filterable.

Detailed Description Text (44):
A mixture of 5AT, guanidine nitrate, and strontium nitrate was prepared having the following composition in percent by weight: 16.19% 5AT, 23.24% guanidine nitrate, and 60.57% strontium nitrate. The powders were ground separately and dry blended. When ignited with only a fuse, fuse and Dupont 4227 smokeless powder, or a propane torch, the composition burned to completion leaving a hard porous readily filterable klinker like residue.

Detailed Description Text (56):
A mixture of 5-aminotetrazole, guanidine nitrate, nitroguanidine and strontium nitrate was prepared having the following composition in percent by weight: 16.47% 5-aminotetrazole, 11.82% guanidine nitrate, 10.08% nitroguanidine, and 61.63% strontium nitrate. These powders were ground separately and dry blended. When ignited at atmospheric pressure with only a fuse, or fuse and Dupont 4227 smokeless powder, the composition burned to completion leaving a hard porous readily filterable klinker like residue. Ignition with only a propane torch was marginal. The pH of a 800 ml aqueous rinse was 7-8.

Detailed Description Text (59):

A mixture of 5-aminotetrazole, guanidine nitrate, nitroguanidine and strontium nitrate was prepared having the following composition in percent by weight: 11.56% 5-aminotetrazole, 16.60% guanidine nitrate, 14.15% nitroguanidine, and 57.69% strontium nitrate. These powders were ground separately and dry blended. When ignited at atmospheric pressure with only a fuse, or fuse and Dupont 4227 smokeless powder, the composition burned to completion leaving a hard porous readily filterable klinker like residue. Ignition with only a propane torch was marginal. The pH of a 800 ml aqueous rinse was 7-8.

Detailed Description Text (71):
A mixture of guanidine nitrate, 5-aminotetrazole, potassium perchlorate, and strontium nitrate was prepared having the following composition in percent by weight: 19.90% guanidine nitrate, 22.40% 5-aminotetrazole, 14.70% potassium perchlorate, and 43.00% strontium nitrate. These powders were ground separately and dry blended. When ignited at atmospheric pressure with a fuse and Dupont 4227 powder, the composition burned rapidly to completion with an audible roar leaving a hard solid mass on completion of combustion.

Detailed Description Text (80):
A mixture of guanidine nitrate, 5-aminotetrazole, potassium chlorate, and strontium nitrate was prepared having the following composition in percent by weight: 19.90% guanidine nitrate, 22.40% 5-aminotetrazole, 20.00% potassium chlorate, and 37.70% strontium nitrate. These powders were ground separately and dry blended. When ignited at atmospheric pressure with a fuse and Dupont 4227 smokeless powder, the composition burned quickly and erratically.

Detailed Description Text (81):
The foregoing examples demonstrates that a significant increase in nontoxic gas output is realized at acceptable and comparable flame temperatures when compared with a very high gas output state of the art baseline composition containing 5-aminotetrazole and strontium nitrate. The substitution of guanidine nitrate for the baseline 5-aminotetrazole fuel component (Examples 11-13) results in a much higher gas mass fraction. This allows a lower weight and volume of propellant to be required in a volume-limited application. In addition because of the decreased concentration of particulates formed during the decomposition fewer solids need to be filtered out of the gas stream. It will also be apparent to those skilled in the art that insignificant levels of toxic gases such as nitrogen oxides and carbon monoxide are formed during the combustion by the preferred compositions without the use of a catalyst as shown by the foregoing examples.

Detailed Description Text (82):
Even when the 5-aminotetrazole fuel of the stoichiometric baseline nonazide composition is only partially substituted with guanidine nitrate (Examples 2, 3, 4 and 5 of Table 1), a significant increase in the gas mass fraction and moles of gas results at comparable flame temperatures. The same result is also accomplished by substituting nitroguanidine alone (Examples 1-5 of Table 3) or in combination with guanidine nitrate for the baseline aminotetrazole component (Examples 17 and 18). Again a significant improvement in gas yield results at slightly higher but acceptable flame temperatures. The flame temperature can also be reduced by substitution of more guanidine nitrate for nitroguanidine with essentially no change in gas fraction or yield. The use of nitroguanidine and/or nitroaminoguanidine is attractive for increasing the overall density of the gas generant composition for use in volume limited applications. In addition, when nitroguanidine is used as the fuel constituent, the flame temperature of the gas generant composition is significantly lower at a comparable molar gas output when compared to the state of the art 5-aminotetrazole based composition. When the aminotetrazole fuel of the baseline composition is partially substituted with nitroguanidine or a combination of nitroguanidine and guanidine nitrate, a significant increase in the moles of gas per 100 g of propellant at comparable flame temperatures results (Examples 6 and 7).

Detailed Description Text (83):
It has also been discovered that when nitroguanidine is incorporated into all of the experimental gas generant compositions used as examples of this invention, that the ignitability of the compositions is greatly improved as well as the burning rate. In addition to a significant increase in gas yield and moles of gas formed, when compared with either prior art azide or nonazide gas generant compositions, the use of combinations of guanidine nitrate and nitroguanidine or nitroaminoguanidine with 5-aminotetrazole as a multiple constituent fuel for the gas generant allows greater precision for tailoring the burning rate, burning rate pressure exponent, ignitability,

and the amount and physical form of the slag and klinkers produced on combustion. The use of a multiple ingredient fuel containing constituents with different densities such as guanidine nitrate and/or nitroguanidine and/or nitroaminoguanidine and/or 5-aminotetrazole as described in the examples of this invention further allows a greater capability for tailoring and adjusting the resultant gas generant composition density while maintaining the required reactant stoichiometry, as that exhibited with prior art singular fuels.

Detailed Description Paragraph Table (1):
TABLE 1 EXAMPLES 1 2 3 4 5 5-aminotetrazole 28.60 16.19 11.29 14.30 9.53 Guanidine nitrate -- 23.24 32.40 29.26 39.00 Nitroguanidine -- -- -- -- -- Nitroaminoguanidine -- -- -- -- -- Strontium nitrate 71.40 60.57 56.31 56.44 51.47 Stoichiometric system yes yes yes yes no Flame temp., Chmbr, .degree.K. 2089 2124 2136 2208 2248 NO.sub.2, Chmbr/Exh, % .008/0 .005/0 004/0 .004/0 .003/0 CO, Chmbr/Exh, % .014/0 .025/0 .028/0 .165/0 .215/0 Nitrogen, Exh, % 50.73 45.25 43.42 45.66 43.97 Oxygen, Exh, % 12.55 8.57 7.24 8.45 7.08 CO.sub.2, Exh, % 22.75 23.87 24.24 24.61 25.23 Water Vapor, Exh, % 13.97 22.32 25.10 23.24 26.33 Gas Mass Fraction, Exh, 65.04 70.34 71.47 72.37 74.81 Moles of Gas/100g, Exh 2.27 2.57 2.73 2.68 2.81

Detailed Description Paragraph Table (2):
TABLE 2 EXAMPLES 6 7 8 9 5-aminotetrazole 16.47 11.56 14.30 9.53 Guanidine nitrate 11.82 16.60 -- -- Nitroguanidine 10.08 14.15 -- -- Nitroaminoguanidine -- -- 21.45 28.60 Strontium nitrate 61.63 57.69 64.25 61.87 Stoichiometric system yes yes yes yes Flame temp., Chmbr, .degree.K. 2193 2227 2236 2287 NO.sub.2, Chmbr/Exh, % .005/0 .006/0 .008/0 .007/0 CO, Chmbr/Exh, % .052/0 .064/0 .067/0 .085/0 Nitrogen, Exh, % 46.32 44.84 48.12 47.25 Oxygen, Exh, % 8.53 7.19 11.25 10.28 CO.sub.2, Exh, % 24.54 25.13 24.08 24.52 Water Vapor, Exh, % 20.46 22.62 18.25 19.67 Gas Mass Fraction, Exh, 72.55 72.55 70.99 72.97 Moles of Gas/100g, Exh 2.66 2.66 2.47 2.53

Detailed Description Paragraph Table (11):
TABLE 5
AIRBAG PROPELLANT SCIENTIFIC ANALYSIS - LTS/ASL010596-1 Baseline LTS-5 LTS-3 LTS-7 LTS-12 LTS-13 LTS-11 LTS-15 LTS-16 LTS-18 LTS-1 1 2 3 4 5 6 7 8 9 10

5-Aminotetrazole 28.60 25 16.19 26.79 20.60 23.26 16.47 11.56 25.00 25.00 Guanidine nitrate -- 25 23.24 12.49 24.12 16.08 11.82 16.60 10.00 20.00 Nitroguanidine -- -- -- -- -- -- 10.08 14.15 10.00 5.00 Strontium nitrate 71.40 50 60.57 60.72 55.28 60.66 61.63 57.69 55.00 50.00 Stoichiometric system YES -- YES -- -- -- YES YES -- -- Flame Temp., Chmbr, .degree.K. 2089 2430 2124 2482 2472 2371 2190 2225 2598 2454 NO.sub.2, Chmbr/Exh, % .008/0 0/0 005/0 .002/0 001/0 004/0 006/0 005/0 0/0 0/0 CO, Chmbr/Exh, % .014/0 4.83/2.66 .025/0 .42/0 .55/0 .17/0 .038/0 .054/0 2.29/1.60 6.75/38 Nitrogen, Exh, % 50.73 51.21 45.25 50.98 48.46 49.16 46.64 45.14 51.78 51.74 Oxygen, Exh, % 12.55 0.00 8.57 2.90 13.91 4.84 8.96 7.66 0.00 0.00 CO.sub.2, Exh, % 22.75 23.52 23.87 26.13 26.53 25.36 24.41 25.01 25.91 23.40 Water Vapor, Exh, % 13.97 21.31 22.32 19.98 23.61 20.64 19.99 22.19 20.59 20.55 Gas Mass Fraction, Exh, % 65.04 75.52 70.34 70.27 72.93 70.30 69.82 71.75 73.07 75.52 Moles of Gas/100 g, Exh 2.27 2.93 2.57 2.54 2.69 2.55 2.52 2.62 2.70 2.93 RESULT OF TESTS AT ATMOSPHERIC PRESSURE (5 GM SAMPLE): Ignition, fuse ++ # + + + + + ++ + Ignition, booster ++ + + ++ ++ ++ + ++ + Ignition, Propane Torch + # # ++ ++ # # # # Burn to completion + + + + + + + + ++ ++ Klinker formation + + + + + + + + ++ ++ pH 800 ml aqueous rinse 7-8 11 11 7-8 7-8 9-11 12-13 ++ = very positive + = positive # = neutral

Current US Original Classification (1):
149/22

Current US Cross Reference Classification (1):
149/36

Current US Cross Reference Classification (2):
149/45

Current US Cross Reference Classification (3):
149/61

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L16	micron same guanidine adj nitrate	9	L16
L15	L14 and (air adj bag or airbag or restraint)	11	L15
L14	L13 and ((149/$)!.CCLS.)	39	L14
L13	50% same micron	9407	L13
L12	(5386775| 6074502)![pn]	2	L12
DB=USPT; PLUR=YES; OP=OR			
L11	6074502.pn.	1	L11
L10	5872329.pn.	1	L10
DB=USPT,PGPB; PLUR=YES; OP=OR			
L9	L8 and ((149/$)!.CCLS.)	88	L9
L8	(restraint or air adj bag) and non-azide	150	L8
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L6	(restraint or air adj bag) and (two near part) same fuel	18	L6
L5	(restraint or air adj bag) and (two near part)	2596	L5
L4	hydrotalcite and ((149/$)!.CCLS.)	3	L4
L3	L1 not L2	26	L3
L2	L1 and (micron or particle adj size)	17	L2
L1	low near fuel and ((149/$)!.CCLS.)	43	L1

END OF SEARCH HISTORY